

✧ RESEARCH PAPER ✧

# *The effectiveness of a pram-walking exercise programme in reducing depressive symptomatology for postnatal women*

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*Accepted for publication March 2004*

Armstrong K, Edwards H. *International Journal of Nursing Practice* 2004; **10**: 177–194

## **The effectiveness of a pram-walking exercise programme in reducing depressive symptomatology for postnatal women**

The purpose of the research project was to examine the effects of exercise, social support and depression on postnatal women who reported experiencing postnatal depression. A 12-week randomized, controlled trial was conducted investigating the effects of an exercise intervention group (a pram-walking programme for mothers and their babies) compared to a social support group (non-structured sessions, similar to a playgroup). Participants in both groups had given birth in the past 12 months. Pretest data of physical fitness and structured questionnaires were compared to post-test effects. The primary outcomes were to reduce the depressive symptomatology and improve fitness levels of participants in the pram-walking group. Secondary outcomes were to improve the social support levels of the participants in both groups and explore women's views about the programmes. It was hypothesized that the pram-walking group participants would improve their feelings of depression and fitness levels compared to the social support group, but that both groups would improve their perceived levels of social support. The results showed that mothers in the pram-walking intervention group improved their fitness levels and reduced their level of depressive symptomatology significantly more than the social support group. There were no significant changes to social support levels for both groups. Therefore, a direct association between improvement in fitness was related to improvement in depression for the pram-walking group. However, it is also suggested that other factors in combination with improvements in fitness influenced improvements in depression levels. It is recommended that pram-walking programmes for mothers with postnatal depression be implemented as pilot research into existing available services.

**Key words:** exercise, intervention programmes, motherhood, postnatal depression, postnatal well-being, pram-walking intervention, social support.

## INTRODUCTION

Postnatal well-being is a complex issue characterized by major changes in physical, social and emotional health. Postnatal depression (PND) is a major public health issue.<sup>1</sup> There is no single pathway by which women develop PND<sup>2</sup> and, therefore, a multifaceted management approach should be the focus of the treatment of PND. However, there are limited, well-controlled trials that assess the benefits of individual and group treatment approaches for improved psychological health outcomes. Exercise interventions offer group management approaches and, when combined with traditional therapy, provide primary and secondary treatment options. This paper assesses the benefits of a pram-walking intervention programme as a moderator for postnatal women who report experiencing PND compared to similar women in a support group.

### Literature on postnatal depression

The birth of a child is often combined with emotional mood swings, irritability, lack of sleep and anxiety for postnatal women. However, for some women this state of emotional upheaval and changes in mood and behaviour can develop into PND, which affects 12–15% of child-bearing women.<sup>2</sup> This can vary depending on the method and time of assessment. The term 'PND' appears to encompass a variety of 'conditions' which have been identified in the literature under three classes: baby blues, postnatal depression and postnatal puerperal psychosis.

Generally, the 'baby blues' are regarded as a fleeting phenomena which affects  $\approx 70\%$  of women around the third to fifth day postpartum.<sup>3</sup> Puerperal psychosis usually requires immediate psychiatric intervention and hospitalization.<sup>4,5</sup> Postnatal depression lies in between these two extremes and is distinguished from the baby blues by its greater severity and longer duration.

There does not seem to be a sole cause of PND; rather multiple factors are likely to be involved. Health professionals seem to have their own ideas about the cause of PND. Since the time of Louis Marcé (1858)<sup>6</sup>, some popular explanations and theories have existed ranging from hormonal<sup>7,8</sup> to social.<sup>9–11</sup> Some believe it is a product of western society where the social constructs of motherhood result in the woman being the predominant caregiver with the subsequent isolation she can experience,<sup>12</sup> or such variables as age, parity or obstetric complications.<sup>13,14</sup> Gjerding and Chaloner recognize that a new baby represents a stressful event in a woman's life.<sup>15</sup>

Harris believes that the aetiology of PND points to the lack of physiological differences between women who do and do not experience PND.<sup>16</sup> The sociological view is that there is no link or relationship between physical variables and changes in a woman's psychological state.<sup>17</sup> Such explanations are important, whatever the theories regarding the cause of PND. Although many theories have been put forward in attempting to explain the aetiology of PND, there is no single theory alone that adequately describes the cause and nature of this complex illness. Predictors of postnatal risk for developing depression are important in developing an understanding of the aetiology of PND. Although each of these variables provide a more powerful understanding of PND, they should not be studied in isolation from one another. Multivariate models<sup>18</sup> need to be considered in order to identify risk factors that impact on the onset of PND.

The National Health and Medical Research Council grouped risk factors into four categories according to the measures of association in relation to supporting evidence.<sup>2</sup> The four categories were:

1. Confirmed risk factors (personal history of depression, depression during pregnancy, marital relationship, lack of support and stressful life events) with agreement from randomized, controlled trials or  $\approx 75\%$  of well-designed cohort studies.
2. Probable risk factors (family history of psychopathology, personality characteristics, negative cognitive style, birth experiences, obstetric complications, infant health and neurotransmitters) with agreement from 40–60% of peer-reviewed, published studies.
3. Possible risk factors (thyroid dysfunction, premature delivery and childhood sexual abuse) with either very little evidence or only equivocal findings available.
4. Possible protective factors (self-esteem and increased availability of support) needing further investigation.

Lumley and Austin identify that primary and secondary management strategies are important as pregnant women and new mothers have frequent contact with health services.<sup>1</sup> Management options include medication, psychotherapy, counselling, group approaches and support strategies.<sup>2</sup> The role of alternative medicine also has been explored recently.<sup>19</sup> Traditionally, social support interventions for depressed postnatal women have been the focus of much research. Offering a support base and weekly counselling by trained nurses are the first treatments of choice for most women with PND.<sup>11,20,21</sup> However, social support is complex and agreement on conceptualization

of social support has not been reached. The research methodologies vary and the findings are mixed.<sup>21</sup>

Limited published research exists as to the effectiveness of individual and group intervention programmes. There are major gaps in the treatment literature related to the lack of well-controlled intervention trials.<sup>2</sup> It is a complex issue and, therefore, no single treatment would be effective for all women. Group treatment interventions allow multifaceted approaches to the treatment of PND and recognize the multiple origins associated with the illness. Well-controlled, pram-walking interventions offer complementary and alternative group intervention approaches, which combine biological and psychosocial elements.

### Exercise and postnatal depression

A pattern of evidence suggests that exercise interventions improve psychological health.<sup>22–25</sup> However, the mechanism by which this happens still remains unclear.<sup>24</sup> Furthermore, the opportunity for well-controlled trials is limited<sup>24</sup> because of the many physical, cognitive and social factors associated with exercise and mental health (Van de Vliet *et al.*, unpubl data, 2003). Details of each of these effects remain unclear and choosing control procedures for exercise is not straight forward.<sup>24</sup> Despite this, the view that exercise training has antidepressant effects is widespread.<sup>22–25</sup> This empirical knowledge provides the base for developing and guiding studies conducted in this area of research.

Sampsel *et al.* found that exercise positively influenced mood in new mothers<sup>26</sup> and Currie and Develin suggest that exercise is one such strategy that could be used to improve psychological well-being for mothers.<sup>27</sup> However, limited published research exists as to the benefits of exercise interventions for postnatal well-being.<sup>27–31</sup> There is a suggestion that exercise might be valuable for postnatal women, but this has not been pursued systematically.<sup>27–32</sup>

The Australian Bureau of Statistics (1998–1999) found that only 16–42% of childbearing women (15–44 years of age) engage in a sufficient amount of physical activity for health maintenance.<sup>33</sup> Currie and Develin found that 65% of survey respondents found pram-walking to be the most popular activity.<sup>27</sup> However, poor weather, lack of time and poor walking paths were the main reasons for why women limited their exercise habits. Furthermore, researchers found that only 29% were able to walk three times per week or more, while 15% walked twice and

19% exercised once per week.<sup>27</sup> This is below the recommended activity required for health benefits.<sup>34,35</sup>

Women in the postnatal period have indicated that they would like to exercise more (69%) and that their participation levels in physical activity had reduced since the birth of their first child.<sup>27</sup> King *et al.* identified that many psychological and personal factors such as time and previous experience of exercise are changeable.<sup>36</sup> It has been suggested that organized programmes to accommodate the mothers' needs would ease the burden, provide motivation to find the time and provide guidance for physical activity.<sup>27,28,37</sup>

### Pram-walking research

Currie and Develin have in recent years surveyed postnatal women for feedback on the potential benefits of pram-walking programmes for mothers with PND.<sup>27,28</sup> They found that 90% of survey correspondents, and all but a few of the focus group subjects, supported the idea of organized community pram-walking groups. Respondents also believed that pram-walking programmes have the potential to increase physical fitness (93%), increase mental well-being (92%) and help reduce PND (87%). The reasons nominated included interaction with other mothers (51%), getting out of the house (26%), benefits for the mind and body (23%), reduction of tiredness and stress (14%), reduction of depression (12%) and the formation of friendships (4%).

However, the consensus expressed from the focus groups was that there was less confidence in the programme's ability to potentially benefit women with PND.<sup>27,28</sup> The main reason was the stigma associated with the illness. The researchers highlighted the sensitivity associated with the illness and identified that programmes would have to be carefully marketed to successfully target mothers at risk. The researchers have successfully recorded the perceived benefits, barriers, community support and stigma associated with pram-walking groups, and it is important in research to gain an insight into the views of womens' issues.

The studies must be viewed with caution in regard to the benefits of exercise for women with PND.<sup>27,28</sup> The women in the study were not assessed for their levels of depression and, therefore, it was not known whether any women in the groups were experiencing PND. To gain a greater understanding of what women think about the benefits of pram-walking exercise programmes for women with PND, it would have been more appropriate

to have women with PND complete the survey tasks. It does not seem appropriate to make such judgements when the cohort of women experiencing PND was not represented.

More needs to be done on implementing exercise programmes to assess the benefits for postnatal women, particularly women with PND. No published studies exist examining the benefits of aerobic pram-walking interventions for women suffering PND. Little has been done on providing alternative forms of treatment other than traditional biological interventions and counselling.<sup>38,39</sup> There is a plethora of intervention studies in the general depression and exercise literature, and positive links have been made between improvement in depressive symptomatology and improvement in physical well-being.<sup>22,25</sup>

Therefore, in order to examine the effectiveness of exercise as a management option for women who report PND, a pilot study was undertaken.<sup>40</sup> The pilot study compared a multi-intervention programme of pram-walking and social support ( $n = 10$ ) to a control group ( $n = 10$ ) which only completed the assigned questionnaires and the fitness test. As a recommendation from the pilot study, it was suggested that follow-up research involve two groups (pram-walking and social support) to enable the researcher to distinguish whether exercise alone could improve PND, and to determine the effect of the social interaction as an independent factor. This would be achieved by adding a social support group which would control for the social aspects of the intervention programme of exercise, which by its group nature, encompassed elements of social support.

A follow-up study was then undertaken 20 months later and is reported in this article. The aim of this study was to compare the well-being of women who reported experiencing PND, and were allocated to a pram-walking intervention programme, to the well-being of similar women in a support group. It was hypothesized that the pram-walking group participants would improve their feelings of depression and fitness levels compared to the social support group, but that both groups would improve their perceived levels of social support.

## MATERIALS AND METHODS

### Design

A 12-week, randomized, controlled trial was conducted to investigate the effects of the pram-walking exercise programme compared to a social support group. Data were collected at pretest/week 1, week 6 and week 12.

Fitness levels were tested prior to and following the intervention programmes. Women in the pram-walking group attended two sessions per week and those in the support group attended one session per week. A follow-up three months after the completion of the intervention period was conducted to assess depressive symptomatology and to gain a greater understanding of the perceived benefits of the programme.

### Sample

Participants were drawn from the Gold Coast region of Queensland, Australia. To be included in the study, the participant had to be English-speaking, have a child between the ages of six weeks and 18 months of age and have an Edinburgh Postnatal Depression Scale (EPDS)<sup>41</sup> score of  $\geq 12$  at the screening phase. Participants were excluded if they had a medical condition that would prevent regular aerobic exercise and they were required to complete the Physical Activity Readiness-Questionnaire (PAR-Q)<sup>42</sup> for clearance to be available for the study.

Participants were recruited either by recommendation from various health professionals (clinic nurse, general practitioner, or GP) or by self-recommendation (Table 1). Women who were identified by health professionals to be 'at risk' or presented with depressive symptomatology were given the EPDS to complete. If a person scored  $\geq 12$  on the EPDS they were offered the advertising flyer, participant information package and consent form to take home to discuss with their family. The individual was also given the PAR-Q to complete. If they answered 'yes' to any questions on the PAR-Q they were required to have a medical certificate from their GP, clearing them to be able to take part in the physical activity. If the participant decided to take part in the study they made contact with the chief investigator and were screened to further check that they met the inclusion criteria. Participants who self-selected for the study followed the same protocol. They made phone contact with the chief investigator and the information was posted out to them. After the participant was cleared to take part in the study, they were contacted by phone and informed of the information evening and projected start of the intervention programmes.

All participants completed the EPDS again prior to the fitness test to ensure that they still met the criteria for entry to the study. All participants still scored above the cut-off of 12, and the original prescores were used in the analysis. Advertising was done via a flyer (placed at shopping centres, childcare centres, child health clinics and

**Table 1** Recruitment of participants

Participant	Number of enquiries	Number of women who decided to participate in the study
Health professionals		
Doctors	12	5
Child health clinic nurses	6	2
Pregnancy and family support	7	3
Hospitals		
Allamanda	3	1
John Flynn	7	4
Pindara	4	1
Self-recommendation		
Newspaper		
<i>Gold Coast Sun</i>	10	3
<i>Gold Coast Bulletin</i>	1	1
Radio		
Interview with ABC	0	0
Television		
ABC news item	1	0
Local Channel 9 Gold Coast news	10	1
Flyer	7	2
Other	2	1
Total	66	24

ABC, Australian Broadcasting Corporation.

playgroups), print media, radio, news items, E-mail and community notice boards. Feature articles promoting the study were presented in the local newspapers (Table 1). Meetings with key health professionals were conducted to inform them of the study and to explain the process of recommendation. Flyers targeting doctors and nurses were distributed with details of the research and contact details.

To determine the appropriate sample size, the results from the pilot study<sup>40</sup> were used in combination with data from previously conducted studies.<sup>41,43-45</sup> To calculate the effect size, an ANCOVA was performed using the approach outlined by Cortina and Nouri.<sup>46</sup> Based on the pilot study,<sup>40</sup> the mean postintervention, depression scores for the control group ( $n = 10$ ) and intervention group ( $n = 10$ ) were 4.6 and 14.2, respectively. Given a correlation between pre- and postdepression scores, the effect size of the difference between the two postintervention depression means controlling for pre-intervention depres-

sion scores was  $d = 2.15$ . This is an extremely large effect size given Cohen suggests  $d = 0.8$  is large.<sup>47</sup> Therefore, using the results from the pilot study,<sup>40</sup> the total sample of 19 in the follow-up study provides power of 0.99 at  $\alpha = 0.05$ .

## Measures

One measure each was used to assess depression levels, social support levels and fitness levels. The EPDS<sup>41</sup> was used to collect data concerning depressive symptomatology. The EPDS is a 10-item, self-report questionnaire which is user-friendly, simple and can be filled out by women in a short time. A score of  $\geq 12$  is an indicator that a woman is suffering from PND.<sup>41,43-45</sup> The screening tool of the EPDS was designed to be acceptable by women postnatally and does not require the health worker administering the scale to have a specialist understanding of psychiatry. Evidence suggests that the EPDS has proven to be highly effective in assessing women who are likely to be

experiencing depressive symptomatology<sup>41,43-45,48</sup> and is well-validated as a measure of a woman's emotional well-being.<sup>41,43,45</sup>

The Social Support Interview (SSI)<sup>49</sup> was administered at week 1, week 6 and week 12 and was used to collect data concerning levels of social support and was administered in a structured questionnaire format. Individual social network scores were given to each source (spouse/partner, parent, confidant). Participants were asked the extent to which they felt free to talk about issues and how often each source was available when needed. The SSI has been found to distinguish between depressed and non-depressed postnatal women.<sup>48-50</sup> The questionnaire has not been validated against other standard measures, which is a limitation of the questionnaire. However, the SSI was chosen for this study as it the most contemporary reliable measure.

All participants completed a fitness test prior to the start of the programmes and at the completion of the intervention period (week 12). The circular walking sub-maximal fitness test (modified version)<sup>51</sup> required the participant to walk to 80% of their maximum age-predicted heart rate (HR).<sup>34</sup> The Cornish Walking Wheel (CWW) fitness test is less invasive than a maximal test to exhaustion and more suitable for women who have given birth recently (Armstrong and Edwards, unpubl. data, 2003). For participants allocated to the pram-walking group, the Borg's Perceived Level of Exertion Scale<sup>52</sup> was used to self-assess intensity of exercise. The Borg scale is a self-report measure where the participant refers to a numerical figure (7-20) to gauge how heavy and strenuous the exercise felt. Participants completed a weekly exercise profile sheet recording their HR, frequency, duration, intensity and type of exercise.

Demographic data were also obtained on age, marital status, number of children, employment, annual family income, education, whether participants were receiving counselling or taking medication and exercise habits both pre- and postbirth (Table 2). Data were also obtained on individual height and weight, which was used for determining the maximum volume of oxygen consumption (VO<sub>2</sub>max). Both groups completed an evaluation questionnaire at the completion of the intervention and at three months. A quantitative approach allowed the research measurement outcomes to be used to determine the effectiveness of the intervention programmes. Both the research team and women also took field notes and observations. This enabled participants to reflect on how

the key issues of exercise, social support and depression had affected their lives.

The focus of the research was on the effects of social support and pram-walking exercise on depression. Although it is recognized that other issues (weight loss, self-esteem, endorphin release, distraction from stress) could potentially influence the outcome, no adjustments were made as the primary objective was to assess the major outcome variables to changes in depressed state.

## Procedure

Ethical approval was obtained from the Queensland University of Technology Human Research Ethics Committee, which conforms to the National Statement on Ethical Conduct in Research involving Humans,<sup>53</sup> Gold Coast Health Services District, which has produced a handbook on ethics and medical research,<sup>54</sup> and Pindara, Allamanda and John Flynn private hospitals. Participants were informed both verbally and in writing prior to the commencement of their participation in the study regarding the protocol and safe nature of all tests and exercise procedures involved. Dr Lamorna Osborne (MD) was the designated health professional for the study. This enabled the research team to contact her or their GP if an individual communicated or expressed suicidal thoughts or dangerous tendencies. Participants gave permission for the research team to do so on the consent form, which was reinforced in their participant information package. If Dr Osborne was contacted, phone support and/or an invitation for an appointment was offered and the consultation was covered under Medicare, an Australian government programme that subsidizes the cost of medical care.

An information evening was held to explain the procedures. Participants' freedom to withdraw consent at any time was offered. The regional social worker was available during office hours and a resource list of contact phone numbers and 24-h help lines were listed in the information packages.

## Fitness testing

Participants were given the choice of five mornings between 06.00 hours and 07.30 hours to attend the fitness testing. The test was conducted on a grassed, flat oval prior to the commencement and at the completion of the intervention period. Volunteers supervised the children and trained physiologists were present to help administer the test and explain the procedures. Participants were required to warm up by walking on the CWW. To maxi-

**Table 2** Sociodemographic characteristics of participants

Characteristic	Pram-walking group (%) (n = 9)	Support group (%) (n = 10)	P
Age (years)			
≤ 29	27 (3)	40 (4)	NS
≥ 30	73 (6)	60 (6)	–
Marital status			
Married/de facto	91 (8)	80 (8)	NS
Other	9 (1)	20 (2)	–
Number of children			
1 or 2	91 (8)	80 (8)	NS
≥ 3	9 (1)	20 (2)	–
Employment			
Homemaker	73 (6)	75 (7)	NS
Part-time/other	27 (3)	25 (3)	–
Annual family income			
≤ \$A30 000	45 (4)	50 (5)	NS
≥ \$A30 001	55 (5)	50 (5)	–
Education			
Completed secondary schooling	73 (6)	80 (8)	NS
Further qualifications	27 (3)	20 (2)	–
Receiving counselling			
Yes	55 (5)	50 (5)	NS
No	45 (4)	50 (5)	–
Taking antidepressant			
Yes	55 (5)	60 (6)	NS
No	45 (4)	40 (4)	–
Exercise habits prebirth			
Twice a week or less	55 (5)	60 (6)	NS
More than twice a week	45 (4)	40 (4)	–
Exercise habits postbirth			
Twice a week or less	82 (7)	80 (8)	NS
More than twice a week	18 (2)	20 (2)	–

NS, not significant.

mize the reliability of the data, strict guidelines were adhered to in the administration of the test. The participant's HR was recorded with polar HR monitors every three minutes as the intensity level increased (Armstrong and Edwards, unpubl. data, 2003). The predicted  $\text{VO}_2\text{max}$  was extrapolated and used to compare groups' pretest data to post-test effects.<sup>34</sup>

### Randomization

At the completion of the fitness test, participants were randomly assigned to either the exercise or social support

group. The procedure of randomization was based upon a four-block, randomized sequence. Sealed envelopes were opened in a sequential manner. Each envelope contained a code (A or B) assigning the subject to either the exercise or social support group.

It was emphasized to participants who were unhappy with their allocation that an independent body performed the allocation and that the chief investigator had no control over group allocation. The participants were told to continue their normal day-to-day activities except for attending the sessions. The pram-walking group was

instructed to meet the following Monday at 09.30 hours and the support group was told to meet the following Tuesday at a room within a community church. The chief investigator and social worker were present to greet all participants from both groups. The chief investigator was present at every session for both groups and the social worker was present at one session of exercise and one session for the support group.

#### *Pram-walking group*

Participants allocated to the pram-walking group were encouraged to attend two pram-walking sessions (Mondays and Wednesdays) at 09.30 hours on flat walking paths at an area on the Gold Coast. This time coincided with the time frame that subjects in Currie and Develin's research recommended as the preferred walking time for mothers. They were required to do the third session needed to improve cardiovascular endurance independently.<sup>34,35</sup> Muscle stretches were done before and after the exercise and HR was recorded at the end of the session. Participants walked for approximately 40 min each session and it was essential that the participants walked at a moderate intensity (60–75% of age-predicted HR) in order to improve fitness<sup>34</sup> and depression levels.<sup>22–25</sup>

The intensity of the exercise sessions was monitored 20 min into the exercise. Participants stopped and their HR was taken by pulse (radial or carotid). The two facilitators took their pulse initially and educated the participants on the correct procedure. They needed to have this skill in order to monitor their HR during the third independent session. The midway break gave an indicator of what pace they should be walking at. The chief investigator calculated a target HR zone (60–75% of maximum HR) for each individual and they were informed to either increase or decrease their pace depending on their HR. After the first few sessions, individuals began to gain a rhythm for the intensity of exercise that was required for them in order to meet their target HR.

#### *Social support group*

The social support group met once per week on Tuesdays from 09.30 hours to 11.00 hours at a room within the local community centre. Children were invited to attend as it was intended to be an environment similar to a playgroup. The room backed onto a fenced garden and the mothers and children were free to move around. Baby and toddler toys were available for the children to play with and refreshments were provided.

No specific topics were discussed. Instead, the women could talk openly about any issues that were of concern or interest to them. It was an environment of social and emotional support where women could share their experiences. The women were able to explore their beliefs about themselves and what PND meant for them. The sessions were non-structured with no therapeutic intention. The aim was to provide support to participants in the form of parental and emotional support. However, when a participant asked for direct help, such as on settling techniques, it was recommended that they speak to an appropriate health professional (e.g. a child health nurse). This non-therapeutic approach was provided to both intervention groups so that they were all receiving the same type of support. It was important that both the chief investigator and social worker provided the same care to all participants from both groups so that one group was not receiving more attention.

### **Facilitators**

The chief investigator attended every session and a child health social worker from Queensland Health attended one pram-walking session and one support session each week for the duration of the intervention. The role of the chief investigator and the social worker was to provide informational support and facilitation. The same support was provided to both groups. Both facilitators acted in the role of 'participant observer'. This involved the observer becoming a member of the observed group, as not only a physical presence, but also into the social and 'symbolic' world.<sup>55</sup> This was achieved by the facilitators making observational notes and obtaining the participants' personal experiences through the questionnaires completed at the end of the intervention period and three months after the completion of the programmes.

### **Data analysis**

To test for the effect of the intervention over time, a two-way analysis of variance was conducted. Group (exercise vs support) was the between-subject factor and time (pre-test/week 1, week 6, week 12) was the within-subject factor or repeated measures factor. Due to the small sample size, tests were conducted to check the assumptions of the statistical tests to be used. The results showed that using Mauchly's Test, the sphericity assumptions of repeated measures for ANOVA were met. Furthermore, tests of homogeneity of variance assumptions also confirmed that this assumption was met. Data analysis was

conducted using the software package SPSS for Windows Release 10.0.<sup>56</sup>

## RESULTS

### Demographics

The demographic data collected from the two groups were not statistically significant, hence the profile of the two groups were similar. In summary (Table 2), the majority of the sample was aged 30 years, in a married/de facto relationship and had between one and two children. Most mothers had secondary education and were the homemaker, with a minority working part-time. The average annual family income was \$A30 000. Just over half the mothers were taking medication and receiving counselling for PND from a social worker, psychologist, GP or psychiatrist. Most of the women were exercising 1–2 days per week prior to taking part in the study. This was a decrease from their prior exercise habits before the birth of their child, where the majority exercised for two sessions per week or more. The most common activities were walking, swimming and gardening. These were done on their own and with no guidance from an instructor. One individual from each group attended a gymnasium and was involved in structured exercise classes. The average age of the children was 11 months. Seventy-five percent were recruited by health professionals and 25% self-selected to participate in the research (Table 1).

Prior to commencing the intervention programmes, there were 24 participants randomly allocated to either intervention group (exercise  $n = 12$ , social support  $n = 12$ ). Five participants withdrew from the study within the first two weeks: three from the pram-walking group and two from the social support group. In the pram-walking group, one participant withdrew due to her child being very unwell while the second participant withdrew as she personally felt that she was not depressed and had issues regarding a difficult birth. Therefore, she felt that she would not benefit from the intervention. The third participant felt that she could not maintain the fitness regime due to being overweight and self-conscious, and was worried that she could not keep up with the other women. In the support group, one participant could not get to the venue as she did not have transport. The second participant was suffering high anxiety and panic attacks due to feeling claustrophobic. She chose to withdraw after two sessions. Therefore, the total number of the cohort was 19, with nine in the pram-walking group and 10 in the support group.

The overall attendance was 75% for the pram-walking group and 73% for the social support intervention group. There was a common pattern for both groups in relation to attendance. The combined reasons for not attending were sick child/children (61%), sickness (15%), holiday (8%), commitment to other engagement, such as a doctor visit (7%), work (5%) and other (4%). The women from both groups were always keen and interested in attending the sessions.

### Psychological well-being

The results from the study showed that the mothers who were randomly assigned to the pram-walking group improved their depressive symptomatology significantly more when compared to the support group. The pram-walking group's mean (M) scores at both week 6 ( $M = 10.2$ ) and week 12 ( $M = 6.3$ ) were  $< 12$ , which indicated that their psychological disturbance reduced over the period of the intervention. In contrast, the support group's scores, at both week 6 ( $M = 15$ ) and 12 ( $M = 13.3$ ), remained above the recommended cut-off for inclusion in the study. This indicates that the support group participants were still suffering from PND<sup>41</sup> at week 6 and at the completion of the study (week 12) (Table 3).

The hypothesis sought to test depressive symptomatology from pre- to postintervention. It predicted that the psychological disturbance for both groups would reduce; however, it would improve more so for the pram-walking group related to taking part in physical activity. The predictor variables were the EPDS scores prior to commencing the interventions. The outcome or dependent variables were the week 6 and week 12 EPDS scores. A multiple linear regression was performed using the scores for the EPDS at week 6 and week 12 as the dependent variables and EPDS scores for pre-intervention as the independent variables.

The results for the EPDS revealed a significant main effect for time ( $F_{(2,16)} = 12.17, P < 0.001$ ) and the interaction of time and group ( $F_{(2,16)} = 5.24, P < 0.02$ ), but no effect for group ( $F_{(1,17)} = 3.78, P > 0.05$ ). The significant interaction was examined to locate the source of the significance. Examination and testing of the estimated marginal means revealed that for the pram-walking group, predepression scores decreased significantly by week 6 (M, standard deviation, or SD,  $P < 0.001$ ) and again by week 12 (M, SD,  $P < 0.05$ ). In contrast, there were no changes in depression scores across the three time points

**Table 3** Edinburgh Postnatal Depression Scale, maximum volume of oxygen consumption and Social Support Interview (Part B) means and standard deviations (in brackets)

Group	EPDS	VO <sub>2</sub> max	SSI
Score range	(0–30)	NA	(0–135)
Pretest			
Exercise	17.25 (4.00)	25.55 (5.50)	100.56 (14.24)
Social support	17.17 (4.45)	25.69 (4.25)	96.10 (16.18)
Week 6			
Exercise	10.22 (3.19)	No testing	98.56 (14.27)
Social support	15.00 (5.91)	No testing	90.50 (20.87)
Week 12			
Exercise	6.33 (3.67)	31.53 (5.30)	99.89 (15.71)
Social support	13.33 (7.66)	22.94 (5.87)	97.30 (19.83)

Pram-walking group:  $n = 9$ ; support group:  $n = 10$ .

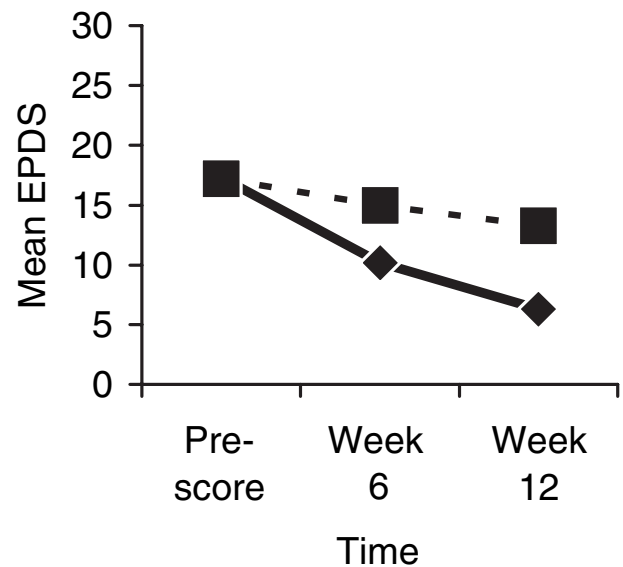
EPDS, Edinburgh Postnatal Depression Scale; VO<sub>2</sub>max, maximum volume of oxygen consumption; SSI, Social Support Interview; NA, not applicable.

for the support group ( $P > 0.05$ ). Therefore, over the course of the intervention, the pram-walking group reduced its levels of depressive symptomatology (Fig. 1). Although the support group showed slight improvements, they were not significant enough to detect a change. These changes could be attributed to the fact that they were receiving some form of intervention in the form of medication and counselling. However, it was not enough of an improvement statistically to detect changes compared with the pram-walking intervention.

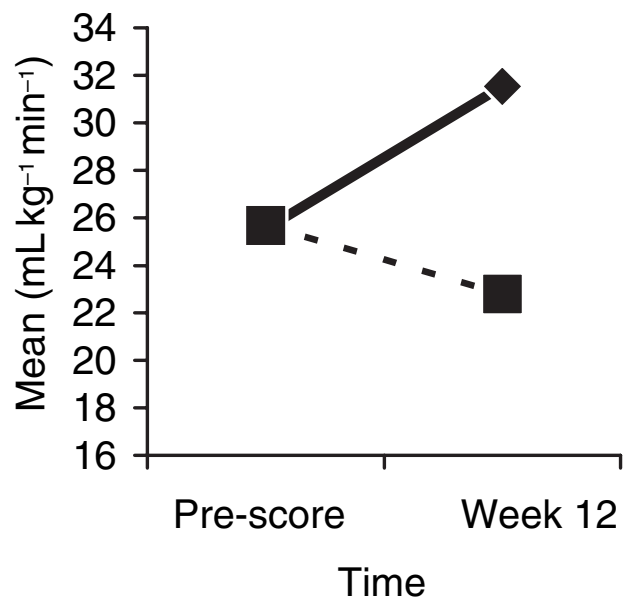
### Fitness

According to Howley and Franks, both groups' mean scores for the pretest phase were in the borderline category.<sup>57</sup> After the intervention periods, the support group reduced to the lowest category ( $22.94 \text{ mL kg}^{-1} \text{ min}^{-1}$ ), but the pram-walking group improved to represent adequate fitness ( $31.53 \text{ mL kg}^{-1} \text{ min}^{-1}$ ) (Table 3 and Fig. 2). This indicates that the fitness levels of both groups were very similar prior to the intervention period. However, at week 12 the pram-walking group's fitness improved compared to the support group.

The hypothesis sought to test the fitness levels from pre- to postintervention. It predicted that the VO<sub>2</sub>max would improve for the participants who received the



**Figure 1.** Edinburgh Postnatal Depression Scale (EPDS) mean scores over time for the exercise group and the support group. —, exercise group; ---, support group.



**Figure 2.** Maximum volume of oxygen consumption (VO<sub>2</sub>max) mean scores over time for the exercise group and the support group. —, exercise group; ---, support group.

pram-walking intervention. The predictor variable was the estimated VO<sub>2</sub>max scores prior to commencing the interventions. The outcome or dependent variables were the week 12 estimated VO<sub>2</sub>max scores. Analysis revealed

that there was a significant main effect for group ( $F_{(1,17)} = 5.78, P < 0.05$ ), and the interaction of time and group ( $F_{(1,17)} = 11.68, P < 0.01$ ), but no main effect for time ( $F_{(1,17)} = 1.74, P > 0.05$ ). The significant interaction was examined to locate the source of the significance. Examination and testing of the estimated marginal means revealed that for the pram-walking group, prefitness levels (M, SD) improved significantly by week 12 (M, SD,  $P < 0.005$ ). In contrast, there was no change in fitness levels between pre- and postscores for the support group ( $P > 0.05$ ) (Fig. 2). In fact, there was a decrease in fitness, but this was not statistically significant.

For the pram-walking group, the average exertion range according to the Borg Scale<sup>52</sup> was 13, which indicated that participants found the exercise sessions to be 'somewhat hard', but still okay to continue. The mean HR was 132 beats per min which indicated that the women, on average, were exercising at 69% intensity of their age-predicted HR.

### Social support

The hypothesis sought to test the combined available levels of social support from week 1, week 6 to week 12. It predicted that the levels of social support for both groups would improve. The predictor variables were the combined (Part B) social support scores from week 1 of the interventions. The outcome or dependent variables were the week 6 and week 12 combined, available levels of social support scores.

The results indicate that neither group had any significant changes to their social support across the 12 weeks. There was no significant main effect for time ( $F_{(2,16)} = 1.79, P > 0.05$ ), group ( $F_{(1,17)} = 0.49, P > 0.05$ ), or the interaction of time and group ( $F_{(2,16)} = 0.49, P > 0.05$ ). Therefore, social support levels did not alter for either group (Table 3) and the hypothesis was not supported. According to O'Hara *et al.*, the level of satisfaction for both the exercise and support groups reflects a high level of perceived social support from their spouse, parent and confidant.<sup>48</sup> This high level of support might suggest a ceiling effect, making improvement on their already high levels of social support difficult.

### DISCUSSION

The statistical results partially support the hypothesis. The first part of the hypothesis stated that compared to a social support group, participants in the pram-walking group would reduce their feelings of depression and improve

their physical fitness. This was supported by the findings. However, the perceived social support levels did not alter for either group; therefore, this section of the hypothesis was not supported.

The results would suggest that irrespective of income, education, prior exercise habits, medication and counselling received, a 12-week, pram-walking intervention has the potential to improve both fitness levels and depressive symptoms for women who reported experiencing PND. The intervention demonstrated that the exercise made a clinical difference to depressive symptomatology. Despite the small sample size, the women were a homogenous group according to age, marital status, education, employment, income, exercise habits, medication and counselling history, and level of social support. The majority of women were recruited by health professionals with 20% of the cohort recruited by a specialist psychiatrist who was treating them for their postnatal disorder. Fifty-seven percent of the women were taking antidepressant medication and 53% were receiving counselling. This indicates that the women were unwell at the onset and it further demonstrates that the pram-walking programme, when used as an adjunct to traditional therapies, alters depressive states.

Therefore, the study suggests that improvement in physical fitness can occur simultaneously with improvements in depressive symptomatology. The research would suggest that exercise that elicits an increase in  $VO_2$ max can improve depressive symptoms. Furthermore, the results would suggest that the pram-walking group had an impact at week 6, with the group having reduced the psychological measure (EPDS) by that time. The trend continued over time to the post-test phase. These trends were observed in the pilot study<sup>40</sup> and further strengthen the evidence of benefits of exercise programmes for depressed postnatal women. The support provided by each other was reported as beneficial; however, this was not enough to alter depressive states. The fact that the social support group was still suffering PND at the completion of the intervention period<sup>41</sup> would suggest that the fitness changes had a direct impact on depression levels (EPDS) and general well-being. It is possible that the women's support levels were already high at the onset of the intervention or that the tool was not sensitive enough to detect the changes that occurred.

Therefore, although it was not researched it is likely that other factors, in combination with improvements in fitness, influenced improvements in depression levels.

There are a number of possible explanations for the belief that depression levels improve as a consequence of the physical activity.<sup>24</sup> Various theories include distraction from stress, alteration in brain monoamines and endorphin release.<sup>58</sup> However, the current evidence regarding these theories is inconclusive and only a limited number of studies exist which test the hypothesis.<sup>23,24,59</sup> Exercise also has emotional elements which depend on social and other environmental aspects, subjects' expectations and other activities undertaken.<sup>24</sup> Other possible explanations include improvement in self-esteem and distraction from negative thoughts.<sup>22–24</sup> Further aspects could include the acquisition of a new skill, attention from the research team and completion of a challenging programme.<sup>60</sup> Also, the participants self-selected for the study and the changes in body shape and image could have impacted on their feelings of self-worth. The women in the exercise programmes reported that the physical activity was achievable, realistic, convenient and enjoyable, which most likely influenced compliance.<sup>24,61,62</sup> Guided physical activity<sup>29,37</sup> and the group nature of the exercise<sup>63</sup> could have potentially influenced the success of the pram-walking interventions. Furthermore, the women strongly indicated that they found comfort in the fact that the other women in the programme were also suffering from a postnatal disorder.

It is not yet clear how psychological, physiological and psychosocial processes and functions interact in the determination of outcomes.<sup>23,24,59</sup> It is unlikely that any single theory, model or hypothesis will suffice;<sup>23</sup> instead, a multiple perspective must be employed. Both pram-walking exercise and PND, and the nature and causation of both are multifaceted and, thus, there are likely to be more complex interactions taking place. Therefore, when reflecting on the results from the research, a direct association between improvements in fitness was related to improvement in depression for the pram-walking group. However, it is also suggested that other factors, in combination with improvements in fitness, influenced improvements in depression levels.

Deciding on the appropriate exercise prescription for psychological improvements is also fraught and debate still continues as to what kind of exercise is most beneficial and what length, intensity, frequency and duration is required to elicit change and maximize its psychological benefits. No research-based guidelines exist; however, the recommendations for general health outlined by the American College of Sports Medicine (ACSM)<sup>34</sup> provide a

sound guideline for depressive cohorts. The literature would suggest that programmes need to be at least nine weeks in duration at a moderate intensity (60–75%), for a minimum of three sessions per week for 30–40 min.<sup>22–25,34,64,65</sup> Of equal importance is to make the programme achievable and realistic,<sup>61</sup> fun and convenient to help with compliance.<sup>62</sup> The intensity might need to be reduced at the onset and increased gradually. This is particularly important for postnatal women as their fitness levels are generally reduced because of the reduction in exercise reported by women after having a baby. The extra demands that the pregnancy placed on the body could also influence fitness levels. Organized, structured sessions where the children were welcome helped ease the burden of childcare and provided motivation to attend. Therefore, all aspects of the women's emotional, social and physical well-being were addressed.

### Limitations

Before drawing conclusions, it is important to point out several limitations in the present research. Four main limitations were identified: (i) the generalizability of the sample; (ii) the difficulty in recruiting participants provided many challenges and impacted on the sample size; (iii) further research on the submaximal CWW fitness test needs to be conducted to ensure that it is an appropriate measure of predicted  $\text{VO}_2\text{max}$ ; and (iv) the possibility that the SSI was not appropriate for the test cohort.

### Generalizability

The women were from all walks of life, with different life experiences and influences, which had affected their postnatal well-being. The women were a homogenous group according to age, marital status, education, employment, income, exercise habits, medication and counselling history, and level of social support. The sample was drawn from one geographical area and, generally, participants were well-educated women who had high levels of social support from the onset. The sample size ( $n = 19$ ) was adequate to ensure appropriate power for data analyses. This was achieved because of the large effect size witnessed between pre- and postdepression scores for the pram-walking group. However, it would be recommended that future research included larger samples from a variety of urban and rural areas with a wide range of socioeconomic and ethnic backgrounds. Considered in light of the studies conducted, larger studies with larger cohorts are needed to confirm the findings.

## Recruitment

After completion and statistical analysis from the pilot study,<sup>40</sup> it became evident that another study that tested the hypotheses would further enhance the research. Therefore, because of the difficulties associated with recruitment, tests were conducted to check the assumptions of the statistical tests that were used. The results showed that using Mauchly's Test, the sphericity assumptions of repeated measures for ANOVA were met. Furthermore, tests of homogeneity of variance assumptions also confirmed that this assumption was met.<sup>56</sup> Therefore, due to the large effect size witnessed between the pram-walking intervention group compared to the social support group, the sample size was adequate to ensure appropriate power for data analyses. The time taken to recruit participants impacted on the number of participants that were recruited. In the pilot study,<sup>40</sup> it took five weeks to recruit 20 participants while for this study, it took six weeks to recruit 24 participants, with the majority of participants recruited by health professionals (75%).

Considering the changes that could possibly occur during the time between recruitment and commencement of the study (six weeks), it was considered essential that the programmes commence immediately. Although a larger sample would have been more desirable, the statistical assumptions were met and it was important to continue so that participants who were recruited earlier did not pull out. As the cohort of women being recruited were experiencing a postnatal illness of varying severity and had a child under 18 months of age, it was considered impressive that the overall number of women recruited for both the pilot study and this study was 44. Getting a larger cohort of participants was always going to be difficult given that the women were experiencing depressive symptomatology and had a young child.

Therefore, in order to avoid the difficulties associated with recruitment, it would be recommended that future programmes recruit on an ongoing basis so that participants have the opportunity to join the programme at any time.

## Fitness tests

Most of the instruments selected for this research were considered relevant to the present study and they generally have been reported to have a high reliability and validity in previous studies. However, it was considered essential for this follow-up research that the CWW be validated against a laboratory-based treadmill test to com-

pare the relationship between the two fitness tests in order to determine whether the participant's HR response and  $VO_2$  during progressive exercise could predict  $VO_{2max}$ .

The limitation of the CWW is that the test had not been evaluated to determine the effectiveness of the programme for postnatal women. However, this was addressed after the pilot study to ensure that the CWW could validate the use of the assumed oxygen ( $O_2$ ) cost of walking with the actual  $O_2$  cost of walking using a treadmill test and expired gas analysis for each stage and speed. The CWW was found to be a reliable field test, which could predict the maximum  $O_2$  consumption for postnatal women. The test offers alternatives for exercise prescription when multiple participants need to be tested and a treadmill test is either too time consuming or not practical for the test cohort. However, more research with larger numbers is required to confirm these findings.

## Social support measure

The SSI<sup>50</sup> was chosen as it was considered to be the most reliable, contemporary tool available. However, the length of the study might not have been long enough to properly detect the effect of the social support outcomes. The anecdotal evidence from women suggests that the social aspect of the exercise is important and it is possible that the SSI was not sensitive enough to detect the changes for the women involved in this research, or as outlined previously, it is possible that the women were already receiving high levels of support from the onset. The duration of the intervention and the possible adverse consequences of depressed behaviour on developing social networks also could have impacted on participants' perceived confidant support.

It is recommended for future studies that a tool be developed specifically for postnatal women who are exercising within a group. The questions could be directed to specific elements of support within the group and how that has affected their social well-being.

## Future directions

There is limited published research regarding the effectiveness of the treatment for PND. Pram-walking programmes provide alternative and complementary therapies in the form of primary and secondary treatment options. The long-term consequences of untreated PND are serious<sup>12,13,41,44</sup> and pram-walking intervention programmes have the potential to reduce the personal, social,

emotional and economic costs to the individual, family and community.

However, despite the potential benefits, limited research is available on management approaches. As the onset of PND is preceded by a clear marker (birth), there is a defined period of highest risk (three months after delivery)<sup>41</sup> and as health professionals have substantial ante- and postnatal contact with women,<sup>2</sup> the potential to explore the options and benefits of exercise programmes as a preventative and early intervention option are extensive.

Collaboration and consensus between community projects, such as pram-walking for mothers with PND, and existing structures and networks need to be utilized to help promote the health benefits, provide sources of referral and funding. Research suggests that individual counselling is effective for mild depressive symptoms<sup>10,41,44</sup> but it is not as cost-effective as group treatment approaches. Group treatment approaches offer cost-effective alternatives to traditional methods.<sup>2</sup> The research suggests that social support groups<sup>66</sup> or health visitor interventions<sup>21,44</sup> can have an influence on improvement of depression levels. However, it has been suggested that there are no cost-saving benefits compared to routine care.<sup>67</sup> Therefore, pram-walking interventions, by their group nature, offer more cost-effective options.

Group exercise interventions such as the pram-walking programme for women with PND provide cost-effective ways of managing women with mild to moderate depression. Evidence exists demonstrating that exercise is as effective as psychotherapy and antidepressant therapy in treating mild to moderate depression.<sup>22–25,38,39</sup> It has also been suggested that the cost of treating depression with running is one-fifth that of psychotherapy.<sup>62</sup> Therefore, more financial support and resources are needed. Integrating this programme into routine activities in the community health centres can be cost-effective.

From a community health perspective, effects of this magnitude have potential for achieving substantial improvements in the physical, mental and social health of postnatal women experiencing depressive symptomatology and living in the community. This can result in cost savings if it can be maintained for long-term programmes and, thus, potential improvements in cardiovascular-related diseases, maintenance of social networks, prolonged depressive episodes and impact on family disruption related to mental illness. Therefore, the long-term effectiveness of the pram-walking intervention

needs to be evaluated and a replication of this research with a long-term evaluation, especially for maintenance, is highly recommended.

### **Implications for further clinical practice**

Offering a support base and weekly counselling by trained nurses are the first treatments of choice for most women with PND.<sup>2,21</sup> However, pram-walking interventions offer complementary and alternative choices to traditional therapies. It takes skill, understanding and knowledge of postnatal disorders to be able to identify women who are considered to be at risk or experiencing symptoms. If health professionals, especially child health nurses, can observe, listen and talk to the women, the course of the illness can be changed.

Positive steps have been adopted by community child health nurses, by providing parenting classes, pram-walking groups, day stay centres and, in some places, PND support groups. General practitioners, community child health nurses and midwives, as primary health care workers, are in key positions to assess women and direct them through providing information, direct care services and referrals if needed. For this purpose, the pram-walking programmes for mothers with PND offer choices for women and health professionals.

The government needs to maintain family values and recognize that some women require intervention and help after the birth of a child. For many, it is the first episode of mental illness and often the mothers do not understand the changes and their behaviour.<sup>2</sup> It is a serious condition that should be addressed further by providing women with choices in the form of primary and secondary treatment options, such as pram-walking exercise programmes designed specifically for women with PND. It was highlighted by the women involved in the pram-walking programmes that they preferred to be with other women who were going through similar difficulties as they understood their situation better. Therefore, the existing pram-walking programmes are an excellent way for postnatal women to socialize and improve their well-being. However, they would need to be separately run and designed with more structure to be suitable for women with PND.

Child health nurses have direct contact with postnatal women, an understanding of postnatal disorders and, if provided with training in exercise prescription, would be in an ideal position to conduct the programmes. The aims of the programmes would be to enhance current available management and to work with women and health profes-

sionals to treat the illness. However, the exercise would not replace current therapy. Instead, it could provide help in speeding up recovery, be used as an intervention measure and complement current therapy. Direct contact and association with health professionals would be essential in order to provide optimal care.

### Implications for further research

In general, the pram-walking intervention in both the pilot and current studies reported in this article have had great effects on the physical and mental well-being of postnatal women with PND. Ongoing study is therefore needed for clarification of this strategy and development of innovative ways to support postnatal women and their families in the community. Further quantitative research is needed to establish the effectiveness of the exercise programmes over a longer period of time and examine whether the pram-walking exercise is adopted as part of daily routine and lifestyle choice. Other control modalities of exercise (mode, intensity, duration) need to be investigated to determine what is most appropriate for depressed postnatal women. Different modes of exercise such as water aerobics, pilates, yoga and fit ball have the potential to be investigated, although issues pertaining to childcare could prove difficult.

Further quantitative and qualitative research is needed to clarify or explore the concept of the association between improvement in depressive symptomatology and physical fitness. It has been suggested that the association between exercise and changes in depressive symptoms are multifaceted. Therefore, other aspects associated with pram-walking programmes that aim to improve psychological well-being need to be explored.

### RECOMMENDATIONS

In order to support clinical practice and encourage further study in the treatment options for PND, the key recommendations for conducting pram-walking sessions for women assessed with having PND are outlined below. Comprehensive training and manuals are required to support the key recommendations. However, it must be highlighted that the single most important recommendation is that future research include studies with larger cohorts. Both of the studies conducted provide a base for future planning and research. The recommendations are:

1. Intervention programmes should be implemented throughout child health centres in Queensland as a pilot programme. Child health nurses are in key positions as

primary health care workers to be trained to conduct the sessions.

2. Comprehensive training and manuals would be provided to staff. This would include first aid inservice, exercise prescription and updates on postnatal disorders. Nurses who have specialized in mental health would be an advantage.

3. The ratio of participants to instructors should be no more than 1 : 15. Therefore, more personal attention could be given to individuals and women would have the opportunity to get to know each other.

4. Programmes should be run in a number of locations so that it is accessible by more women. For example, on the Gold Coast the sessions could be conducted at the northern, central and southern locations.

5. Guidelines to improvement in cardiovascular endurance as outlined by the ACSM<sup>34</sup> should be followed. This involves the participant pram-walking at least three times per week for a minimum of 30 min at a moderate intensity (60–75% of age-predicted HR). However, initially it is essential that the participant enjoys the activity, it is realistic and achievable. Over time, they could gradually increase their pace and intensity to the basic recommendations.

6. For best physiological and psychological improvements, the women should attend the programme for at least 12 weeks. The programmes should be ongoing so that the women have the opportunity to join at any time and health professionals have access to referral at all times.

7. Fitness progress needs to be monitored continually to ensure that the participants are exercising to their potential and intensity. This could be achieved by monitoring their age-predicted HR and to ensure that they are within their target HR zone.

8. The instructor should provide ongoing assessment to the participant and health professionals in order to provide quality of care and to improve patient outcomes. It would be recommended that the EPDS be used to assess depression levels. This could be used as a tool to report back to the health professional that referred the mother.

### CONCLUSION

Pram-walking exercise programmes offer cost-effective ways of managing PND. They offer primary and secondary management options for both women and health professionals. In combination with other treatment options, such as cognitive behavioural therapy, medication and group sessions, exercise offers complementary and alter-

native choices. Standard forms of treatment are not always effective and the need for alternative choices as an adjunct to traditional strategies is needed. Therefore, pram-walking interventions for women who report experiencing PND offer an opportunity for improved quality of life and patient outcomes.

### ACKNOWLEDGEMENTS

The authors would like to acknowledge the School of Nursing, Queensland University of Technology, Queensland, Australia, for financial support and the following people: Dr David Rowbottom PhD (Human Movements, Queensland University of Technology), Dr Geoffrey Cornish MD, Dr Susan Roberts MD, Lyn Pantle, Dr Lamorna Osborne MD and Violet DeVries, as well as Gold Coast District Health Services. We would also like to thank Pindara, Allamanda and John Flynn private hospitals, and the mothers who volunteered for the study. Without their participation, this important research would not be possible.

### REFERENCES

- Lumley J, Austin MP. What interventions may reduce postpartum depression? *Current Opinion in Obstetrics and Gynecology* 2001; **13**: 605–611.
- National Health and Medical Research Council. *Postnatal Depression. A Systematic Review of Published Scientific Literature to 1999*. Canberra: National Health and Medical Research Council, 2000.
- Nicolson P. *Post-natal Depression: Psychology, Science and the Transition to Motherhood*. London: Routledge, 1998.
- Boyce P, Stubbs J. The importance of postnatal depression. *Medical Journal of Australia* 1994; **161**: 471–472.
- Brockington IF, Kumar R. *Motherhood and Mental Illness*. London: Academic Press, 1982.
- Marcé L. *Traité de la Folie des Femmes Enceintes, des Nouvelles Accouchées, de Nourries*. Paris: Bailière, 1858.
- Dalton K. *Depression After Childbirth*. Oxford: Oxford University Press, 1980.
- Gregoire A. Hormones and postnatal depression. *British Journal of Midwifery* 1995; **3**: 99–103.
- O'Hara MW, Swain AM. Rates and risk of postnatal depression—A meta-analysis. *International Review of Psychiatry* 1996; **8**: 37–54.
- Cutrona CE, Troutman B. Social support, infant temperament, and parenting self-efficacy: a mediational model of postpartum depression. *Child Development* 1986; **57**: 1507–1518.
- Paykel ES, Cooper Z. Life events and social stress. In: Paykel ES (ed.). *Handbook of Affective Disorders*. New York: Guilford Press, 1992; 149–170.
- Cox J. *Postnatal Depression: a Guide for Health Professionals*. Edinburgh: Churchill Livingstone, 1986.
- Astbury J, Brown S, Lumley J, Small R. Birth events, birth experiences and social differences in postnatal depression. *Australian Journal of Public Health* 1994; **18**: 176–184.
- Murray L, Cartwright W. The role of obstetric factors in postpartum depression. *Journal of Reproductive and Infant Psychology* 1993; **11**: 215–219.
- Gjerdingen D, Chaloner K. Mothers' experience with household chores and social support during the first postpartum year. *Women and Health* 1994; **23**: 3–14.
- Harris B. Biological and hormonal aspects of postpartum depression mood: Working toward strategies for prophylaxis and treatment. *British Journal of Psychiatry* 1994; **164**: 288–292.
- Albright A. Postpartum depression: An overview. *Journal of Counselling and Development* 1993; **71**: 316–320.
- Swendsen JD, Mazure CM. Life stress as a risk factor for postpartum depression: Current research and methodological issues. *Clinical Psychology Science and Practice* 2000; **7**: 17–31.
- Mantle F. The role of alternative medicine in treating postnatal depression. *Complementary Therapies in Nursing and Midwifery* 2002; **8**: 197–203.
- Wickberg B, Hwang P. Do not minimize signs of postpartum depression! Early intervention essential to prevent negative consequences for the child. *Lakartidningen* 2001; **98**: 1534–1538.
- MacArthur C, Winter HR, Bick DE *et al.* Effects of redesigned community postnatal care on women's health 4 months after birth: a cluster randomised controlled trial. *Lancet* 2002; **359**: 378–385.
- North T, Corth TC, McCullagh P, Vutran Z. Effect of exercise on depression. *Exercise and Sport Sciences Reviews* 1990; **18**: 379–415.
- Scully D, Kremer J, Meade M, Graham R, Dudgeon K. Physical exercise and psychological well being: a critical review. *Journal of Sports Medicine* 1998; **32**: 111–120.
- Salmon P. Effects of physical exercise on anxiety, depression, and sensitivity to stress. *Clinical Psychology Review* 2001; **21**: 33–61.
- Mutrie N. The relationship between physical activity and clinically defined depression. In: Biddle SJH, Fox KR, Boutcher SH (eds). *Physical Activity and Psychological Well-Being*. London: Routledge, 2000; 46–62.
- Sampselle CM, Seng J, Yeo SA, Oakley D. Physical activity and postpartum well-being. *Journal of Obstetric and Gynecological Neonatal Nursing* 1999; **28**: 41–49.
- Currie JL, Develin ED. Stroll your way to well-being: A survey of the perceived benefits, barriers, community support, and stigma associated with pram walking groups designed for new mothers, Sydney. *Health Care for Women International* 2002; **23**: 882–893.

- 28 Currie JL, Develin ED. The Stroller Pram Walking Programme. A community intervention aimed at increasing the physical activity level of mothers with young children. *Health Promotion Journal of Australia* 2000; **10**: 57–59.
- 29 Koltyn K, Schultes S. Psychological effects of an aerobic exercise session and a rest session following pregnancy. *Journal of Medicine and Physical Fitness* 1997; **37**: 287–291.
- 30 May A. Using exercise to tackle postnatal depression. *Health Visitor* 1995; **68**: 146–147.
- 31 Nordhagen IH, Sundgot-Borgen J. Physical activity among pregnant women in relation to pregnancy-related complaints and symptoms of depression. *Tidsskrift for den Norske Laegeforening* 2002; **122**: 470–474.
- 32 Kull M. The relationship between physical activity, health status and psychological well-being of fertility-aged women. *Scandinavian Journal of Medicine and Science in Sports* 2002; **12**: 241–247.
- 33 Australian Bureau of Statistics. Participation in sport and physical activities. Canberra: Australian Government Publishing Service, 1998–1999. No. 4177.0.
- 34 McConnell TR. Cardiorespiratory assessment of apparently healthy populations. In: American College of Sports Medicine (ed.). *Resource Manual for Guidelines for Exercise Testing and Prescription*, 4th edn. Baltimore: Williams & Wilkins, 2001; 361–366.
- 35 Commonwealth Department of Health and Family Services. *Developing an Active Australia: A Framework for Action for Physical Activity and Health*. Canberra: Commonwealth Government of Australia, 1998.
- 36 King AC, Blair SN, Bild DE *et al.* Determinants of physical activity and intervention in adults. *Medicine and Science in Sports and Exercise* 1992; **24**: S221–S236.
- 37 Lox CL, Treasure DC. Changes in feeling states following aquatic exercise during pregnancy. *Journal of Applied Social Psychology* 2000; **30**: 518–527.
- 38 Manber R, Allen JB, Morris MM. Alternative treatments for depression: Empirical support and relevance to women. *The Journal of Clinical Psychiatry* 2002; **63**: 628–640.
- 39 Jorm AF, Christensen H, Griffiths KM, Rodgers B. Effectiveness of complementary and self-help treatments for depression. *The Medical Journal of Australia* 2002; **176**: S84–S96.
- 40 Armstrong KJ, Edwards H. The effects of exercise and social support on mothers reporting depressive symptoms: a pilot randomized controlled trial. *International Journal of Mental Health Nursing* 2003; **12**: 130–138.
- 41 Cox J, Holden JM, Sagovsky R. Detection of postnatal depression: development of the 10 item EPDS. *British Journal of Psychiatry* 1987; **150**: 782–786.
- 42 Canadian Fitness and Lifestyle Research Institute. The Research File. Exercise, anxiety and depression. *Canadian Medical Association Journal* 1994; **151**: 151–1163.
- 43 Boyce P, Stubbs J, Todd A. The Edinburgh Postnatal Depression Scale: Validation for an Australian journal. *Australian and New Zealand Journal of Psychiatry* 1993; **27**: 472–476.
- 44 Holden J, Phil M. Postnatal depression. Its nature, effects and identification using the Edinburgh Postnatal Depression Scale. *Birth* 1991; **18**: 211–219.
- 45 Murray L, Carothers A. The validation of the Edinburgh Postnatal Depression Scale on a community sample. *British Journal of Psychiatry* 1990; **157**: 288–290.
- 46 Cortina JM, Nouri H. Effect size for ANOVA design. University papers series on quantitative applications in the social sciences. Thousand Oaks, CA, USA: Sage, 2000. No. 07–129.
- 47 Cohen J. *Statistical Power for the Behavioral Sciences*, 2nd edn. Hillsdale, NJ, USA: Lawrence Erlbaum, 1988.
- 48 O’Hara MW, Zekoski EM, Phillip LH, Wright EJ. Controlled prospective study of postpartum mood disorders: Comparison of childbearing and non-childbearing women. *Journal of Abnormal Psychology* 1990; **99**: 3–15.
- 49 O’Hara MW. *Postpartum Depression: Causes and Consequences*. New York: Springer-Verlag, 1995.
- 50 O’Hara MW, Rehm LP, Campbell SB. Predicting depressive symptomatology: Cognitive-behavioural models and postpartum depression. *Journal of Abnormal Psychology* 1982; **91**: 457–461.
- 51 Cornish G. Personal exercise prescription. *Journal of Australian Medical Association* 1983; **1**: 163–165.
- 52 Borg G. *Borg’s Perceived Exertion and Pain Scales*. Champaign, IL, USA: Human Kinetics Books, 1998.
- 53 National Health and Medical Research Council. *National Statement on Ethical Conduct in Research Involving Humans*. Canberra: National Health and Medical Research Council, 1999.
- 54 Gold Coast District Health Service. *Medical Research Handbook Involving Ethical Conduct*. Southport, Queensland, Australia: Gold Coast District Health Service, 1997.
- 55 Robson C. *Real World Research*. Oxford: Blackwell Publishers, 1997.
- 56 Norusis MJ. *SPSS for Windows: Base System User’s Guide, Release 10.0*. Chicago: SPSS, 2000.
- 57 Howley ET, Franks BD. *Health Fitness Instructor’s Handbook*. Champaign, IL, USA: Human Kinetics Books, 1992.
- 58 Morgan W. Affective beneficence of vigorous physical activity. *Medicine and Science in Sports and Exercise* 1985; **17**: 94–100.
- 59 Gauvin L, Spence JC. Physical activity and psychological well-being: Knowledge base. Current issues and caveats. *Nutrition Reviews* 1996; **54**: S53–S65.
- 60 Palmer LK. Effects of a walking program on attributional style, depression, and self-esteem in women. *Perceptual and Motor Skills* 1995; **81**: 891–898.
- 61 Franklin B. Programme factors that influence exercise adherence: Practical skills for the clinical staff. In: Dishman RK (ed.). *Exercise Adherence: Its Impact on Public Health*.

- Champaign, IL, USA: Human Kinetics Books, 1988; 237–258.
- 62 Griest JH, Klein MH, Eischens RR *et al.* Running as treatment for depression. *Comprehensive Psychiatry* 1979; **20**: 41–54.
- 63 Ribisl PM, Shumaker SA. Enhancing social support and group dynamics. In: Roitman JL, Herridge M (eds). *American College of Sports Medicine*, 4th edn. Baltimore: Williams & Wilkins, 2001; 568–572.
- 64 Nicoloff G, Schwenk MD. Using exercise to ward off depression. *The Physician and Sports Medicine* 1995; **23**: 44–58.
- 65 Moses J, Steptoe A, Matthews A, Edwards S. The effects of exercise training on mental well-being in the normal population: a controlled trial. *Journal of Psychosomatic Research* 1989; **33**: 47–61.
- 66 Meager I, Milgrom J. Group treatment for postpartum depression: a pilot study. *Australian and New Zealand Journal of Psychiatry* 1996; **30**: 852–860.
- 67 Morrell CJ, Spiby J, Stewart J, Walters S, Morgan A. Costs and effectiveness of community postnatal support workers: Randomised controlled trial. *British Medical Journal* 2000; **321**: 593–598.